Quantitative Measurements of Mass and X-Ray Target Emissions Relevant to NIF Target Chamber Design

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The proposed NIF facility target chamber must tolerate a considerable flux of soft x-rays, target material, and neutrons. While the current Nova facility cannot produce the large neutron flux expected on NIF, we have been able to do experiments to quantify the mass and momentum distribution of the expanding hohlraum walls, as well as the effects of soft x-rays on potential first walls and optics. The mass and momentum spatial distributions are in qualitative agreement with simulations, with the measurements being broader (order 25 degree half angle) than the strongly peaked (5 degree half angle) simulations. The average velocity is in good agreement with the calculations. Large copper shields, mounted on hohlraums used on some Nova experiments, were found to produce large amount of copper debris. The directionality of this copper indicates that it is not, for the most part, produced by the stray laser light it is designed to intercept, but rather is vaporized/liquefied/spalled by the expanding hohlraum. Recent experiments of the Omega laser successfully used thin (2 um) walled gold hohlraums and thin (100 um), small, plastic diagnostic shields, to minimize debris. We will discuss the applicability of this design to NIF targets, considering the much larger levels of light which must be blocked. Finally, we exposed fused silica to the soft x-ray flux generated by the hohlraums, and measured the amount of material ablated. This is found to be in good agreement with calculations. We have found that for the proposed NIF chamber design, a current-technology anti-reflection coating on the final optical element is at risk, even from experiments which do not have appreciable fusion yield.

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